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The biodiversity hypothesis and allergic disease: world allergy organization position statement

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Abstract

Biodiversity loss and climate change secondary to human activities are now being associated with various adverse health effects. However, less attention is being paid to the effects of biodiversity loss on environmental and commensal (indigenous) microbiotas. Metagenomic and other studies of healthy and diseased individuals reveal that reduced biodiversity and alterations in the composition of the gut and skin microbiota are associated with various inflammatory conditions, including asthma, allergic and inflammatory bowel diseases (IBD), type1 diabetes, and obesity. Altered indigenous microbiota and the general microbial deprivation characterizing the lifestyle of urban people in affluent countries appear to be risk factors for immune dysregulation and impaired tolerance. The risk is further enhanced by physical inactivity and a western diet poor in fresh fruit and vegetables, which may act in synergy with dysbiosis of the gut flora. Studies of immigrants moving from non-affluent to affluent regions indicate that tolerance mechanisms can rapidly become impaired in microbe-poor environments. The data on microbial deprivation and immune dysfunction as they relate to biodiversity loss are evaluated in this Statement of World Allergy Organization (WAO). We propose that biodiversity, the variability among living organisms from all sources are closely related, at both the macro- and micro-levels. Loss of the macrodiversity is associated with shrinking of the microdiversity, which is associated with alterations of the indigenous microbiota. Data on behavioural means to induce tolerance are outlined and a proposal made for a Global Allergy Plan to prevent and reduce the global allergy burden for affected individuals and the societies in which they live.

Keywords: Allergy plan, Biodiversity, Civilization disease, Epigenetics, Immune dysfunction, Microbiota, Microbiome, Urbanization

Introduction

Biodiversity loss is a global concern with a variety of possible adverse consequences for humanity. The reasons for this loss are complex and are in large part due to the consequence of industrialization, pollution and utilization of chemicals, which impact the environment and the microorganisms with which humans have lived since time immemorial. In recent years, attention has been paid to the potential health effects of this altered biosphere. Indeed, the two global megatrends, one in the state of biodiversity and the other in the prevalence of mucosal inflammatory diseases, may be more closely linked than is commonly recognized (Figure 1).

Inflammation is a cardinal feature of asthma and allergic diseases, autoimmune diseases, and many forms of cancer [1], but more recently less tangible associations have been linked to these trends such as an increased incidence of depression associated with inflammatory markers [2]. Thus far, the increase in the prevalence of inflammatory disorders is a phenomenon largely restricted to the developed world, while such disorders are still uncommon among populations in non-affluent regions, i.e. those regions, which still have more traditional non-urban lifestyles [3,4]. Adoption of cultural patterns and nutritional habits from affluent countries, together with declining frequency and severity of intestinal parasitic

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